DOCUMENT RESUME

ED 429 592 IR 019 553

AUTHOR	Kuh, George D.; Vesper, Nick
TITLE	Do Computers Enhance or Detract from Student Learning?
PUB DATE	1999-04-00
NOTE	20p.; Paper presented at the Annual Meeting of the American Educational Research Association (Montreal, Quebec, Canada, April 19-23, 1999).
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	*College Students; *Computer Literacy; Higher Education; Information Technology; Outcomes of Education; Questionnaires; Secondary Education; Undergraduate Students
IDENTIFIERS	*College Student Experiences Questionnaire; Computer Use; Computer Users; Technology Role

ABSTRACT

The purpose of this study is to determine the relationships between students' self-reported use of computers and other information technologies and the outcomes of college thought to be essential for success during and after college. Data for this study are from the College Student Experiences Questionnaire (CSEQ) national research program. The sample is composed of 125,224 undergraduates from 205 four-year colleges and universities in the United States who completed the third edition of the CSEQ between 1990 and 1997. GNCMPTS is the gain item that asks students to indicate the extent to which they made progress during college in using computers and other information technologies. The sample was divided into two groups: High Gainers who reported substantial progress on GNCMPTS and Low Gainers. The results of this study unequivocally demonstrate that familiarity with computers contributes to, and does not detract from, the development of other skills and competencies considered to be important to success after college. Four tables present statistics. The CSEQ background variables and gains scales are appended. Contains 39 references. (AEF)

Do Computers Enhance or Detract From Student Learning?

George D. Kuh
Professor of Higher Education
Center for Postsecondary Research and Planning
School of Education, Indiana University
Bloomington, IN 47405-1006
Tel: 812-856-8383
Fax: 812-856-8394
Internet: kuh@indiana.edu

Nick Vesper
Director of Policy and Research
State Student Assistance Commission of Indiana
ISTA Center, 150 W. Market St., Suite 500
Indianapolis, IN 46204
Tel: 317-233-5094
Fax: 317-232-3260
Internet: nvesper@ssaci.state.in.us

Presented at the annual meeting of the American Educational Research Association,
Montreal, Canada, April, 1999

Do Computers Enhance or Detract From Student Learning?

Introduction

Information technology (IT) promises to change virtually every aspect of college and university life (Abeles, 1998; Dolence & Norris, 1995; Green & Gilbert, 1995; Gilbert, 1996; Hannum, 1996; Kozma & Johnston, 1991; West, 1996). Used appropriately and in concert with powerful pedagogical approaches, technology is supposed to enhance student learning productivity. It does this by enriching synchronous classroom activities and providing students with engaging self-paced and asynchronous learning opportunities that enable students to learn more than they would otherwise at costs ultimately equal to or below that of traditional classroom-based instruction (Hannum, 1996; Johnstone, 1993; Twigg, 1995). Desktop computers are all but ubiquitous, making accessible intellectual resources from around the world, not just the host institution (Green, 1996). And increasing numbers of students are using information technology as shown by the percentages of students using computers. In the 1980s, only 32% of students reported substantial progress in becoming familiar with computers during college. By the mid-1990s this percentage jumped to about 60% (Kuh, Connolly, & Vesper, 1998). In fact, most students (83%) today have used the Internet for research or homework in their senior year of high school prior to matriculating (Higher Education Research Institute, 1998).

Most of the studies examining the impact of IT on learning are focused at the individual course level with "impressive" results (Hibbs, 1999). For example, computer use has been shown to enhance productive collaboration among students (Alavi, 1994) and encourage higher levels of student participation than traditional classrooms (Oblinger & Maruyama, 1996). According to Mallam and Wee (1998, p. 24), communicating electronically:

> achieves greater equality in participation because everybody gets to provide input to the discussion anonymously; the anonymity ensures that every idea is considered on its own merit, not on the basis of where it came from. Because the ideas are shared simultaneously rather than sequentially, there is a parallel processing of ideas and broad participation occurs efficiently.

At the University of California at Northridge, students in a virtual classroom tested 20 percent higher than students in a traditional classroom and at the University of Oregon distance education students (those taking classes on-line) earned higher grades than their on-campus counterparts taking the same courses (though Internet access reliability created occasional performance problems) (Bothan, 1998). Thus, IT appears to be a very promising educational tool and the vast majority of those writing in this area confidently predict that computing and other IT-related functions technology will revolutionize certain aspects of the teaching-learning process in the near term (Abeles, 1998; Dolence & Norris, 1995; Green & Gilbert, 1995; Hannum, 1996; Twigg, 1997).

At the same time, "we need to be honest about the gap between aspirations and performance... We don't yet have clear, compelling evidence about the impact of information technology on student learning and educational outcomes" (Morrison, 1999, p. 3). Toward this end, the American Association for Higher Education developed the Flashlight Program under the auspices of its affiliate for Teaching, Learning, and Technology (Ehrmann, 1995) to document, among other things, the effects of technology on student learning.

Others worry that unintended, negative side effects associated with computer use are occurring and are either being overlooked or ignored. One that cannot be ignored is cost (Morrison, 1999; Upcraft, Terenzini, & Kruger, 1999). Information technology typically demands non-trivial reallocations of campus resources to establish, update, and upgrade software, hardware and networks. In addition, there are concerns about the deterioration of the quality of social relations between students and faculty and among peers. Less frequent meaningful face-to-face interactions could mute the development of interpersonal communication and other skills as students increasingly rely on information technologies to obtain information, prepare class assignments, and communicate with one another and their teachers (Upcraft et al., 1999). Some evidence suggests this may be happening. For example, when compared with their counterparts in the 1980s a smaller proportion of students in the 1990s reported making substantial progress in understanding others. Students in the 1990s also expended less effort in exchanging information in conversations with peers (Kuh, Connolly & Vesper, 1998). Anecdotal information indicates that other social welfare challenges may be associated with computers and technology, especially on residential campuses. As one parent opined:

> There is a huge lifestyle/living issue that has been created by computers in dorm rooms. Students spend most of their time in their rooms because of computers. This creates cohabitation problems beyond dorm rules and regulations as well as privacy and courtesy dilemmas. What do you do when your roommate is on the computer all night and you need to sleep? Or is playing videos at any time of day or night and you need to study? Where is the private time for students? Dorm rooms are becoming a 24-hour communications terminal. (Rhodes, 1999, p. 11)

In sum, while computing and information technology are changing virtually every aspect of the educational and social landscape, little evidence is available beyond student performance in individual classes to determine how the use of IT is affecting the acquisition of a host of desired outcomes of college.

Purpose

The purpose of this study is to determine the relationships between students' self-reported use of computers and other information technologies and the outcomes of college thought to be essential for success during and after college. The guiding

question is: Does competence in computers contribute to, or detract from, the development of the skills and competencies considered to be important to success after college? These skills and competencies include learning on one's own, thinking analytically and logically, synthesizing ideas and concepts, writing clearly and effectively, and working effectively with others.

Methods

Instrument

The data for this study are from the College Student Experiences Questionnaire (CSEQ) national research program. The third edition of the CSEQ (Pace, 1990) gathers information about students' background and their experiences in three areas: (a) the amount of time and energy (effort) students devote to various activities (14 Effort Scales) as well as studying, reading, and writing, (b) their perceptions of important aspects of their institution's environment (8 Environment Scales), and (c) what they gained from attending college (23 Estimate of Gains items). GNCMPTS is the gain item that asks students to indicate the extent to which they made progress during college in using computers and other information technologies. Response options for all gains items are: 1="very little," 2="some," 3="quite a bit," and 4="very much."

According to Ewell and Jones (1996), the CSEQ has excellent psychometric properties and the instrument has high to moderate potential for assessing student behavior associated with college outcomes. Self-reported CSEQ gains scores have been shown to be generally consistent with other evidence, such as results from achievement tests (Brandt, 1958; DeNisi & Shaw, 1977; Hansford & Hattie, 1982; Lowman & Williams, 1987; Pace, 1985; Pike, 1995). The gains items produce a normal distribution of responses from students both within and across institutional types. Inter-item correlations for the 23 gains items range from .08 to .80, with the arts and computer items having the lowest correlations with other gains items.

Appendix A lists the CSEQ background variables and their values. Appendix B lists the CSEQ gain scales.

Sample

The sample is composed of 125,224 undergraduates (59% female) from 205 four-year colleges and universities who completed the third edition of the CSEQ between 1990 and 1997. The institutions are from every region of the country and include 38 research universities, 23 doctoral universities, 74 comprehensive colleges and universities, 23 selective liberal arts colleges, and 47 general liberal arts colleges as categorized in the Carnegie Foundation for the Advancement of Teaching (1994) classification index.

Data Analysis

The sample was divided into two groups: (a) High Gainers defined as those who reported substantial progress on GNCMPTS (66,492 or 53%) where substantial progress represents the combined responses of those who indicated "quite a bit" and "very much"; and (b) Low Gainers or those who made only "some" or "very little" progress (59,795 or 47%). T-tests were used to compare the two groups on the following background variables: sex, age, grades, time spent on schoolwork, employment, educational aspirations, parental education, and who pays college costs. Because there were small, statistically significant differences in student background characteristics between the two groups (Table 1), an ANOVA with covariants was used to determine how those students who made substantial gains on GNCMPTS scored on the other gain items.

To estimate the contribution of GNCMPTS to other gains, the variable ALLGAIN was created by summing the scores on all 23 gain scores. Another variable, LEARN, was created by summing seven gains items that taken together are an essential foundation for continuous learning after college. They are GNANALY (analytical thinking), GNINQ (learning on one's own, finding information), GNOTHERS (ability to get along with different kinds of people), GNSYNTH (seeing relationships and putting ideas together), GNTEAM (ability to function as a team member), GNWRITE (writing clearly, effectively), and GNCMPTS.

Socioeconomic status and student ability are highly correlated and positively influence college outcomes (Pascarella & Terenzini, 1991). To take this into account two control variables were created, socioeconomic status (SES) and student ability (COGNITIVE). SES is the sum of the variables that measure who pays for college (EXPENSE), how much the student works on a job (TIMEWORK but reversed in value), and PARGRAD (but recoded so that 0=neither parent, 1=either parent, and 2=both parents). The variable, COGNITIVE, is the sum of self-reported grades (GRADES), educational aspirations (ADVDEG, but reversed), and the amount of time students devote to their studies (TIMESCH, a combination of hours in class and studying or preparing for class). The component variables (described in Appendix A) were converted to z-scores before summing. These variables are used as covariates in an ANOVA in order to compare scores on the CSEQ gain scales and the combined gain scores, ALLGAIN and LEARN.

Multiple regression was used to analyze the relative influence of each of the LEARN component gains measures including GNCMPTS on the overall indicator of gains, ALLGAIN, as well as on LEARN itself. Partial correlations were examined to determine the specific contribution of GNCMPTS to ALLGAIN after removing the effects of the other six gain measures that contribute to LEARN.

Results

Table 1 summarizes the t-tests on the background variables. High and Low Gainers differed ($p<.000$) on age, sex, grades, the amount of time devoted to school work (which includes attending class and studying), and the amount of college expenses paid by the family. For only one of these variables was the difference between groups large enough to be practically significant, the amount of time spent on schoolwork (TIMESCH). High Gainers devoted more time to school work, a mean of 3.16 compared to 2.97 for the Low Gainers.

[Insert Table 1 about here]

Table 2 lists the means of the 25 gain variables (including ALLGAIN, LEARN, and GNCMPTS) corrected for the SES and COGNITIVE covariates. The percentage difference in the means is measured two ways: (1) as an increase over Low Gainers' score, and (2) the increase as a percentage of the range of the values used to define the gain score. Also displayed is the difference in the means for the Low Gain and High Gain groups, the percentage difference of the High Gain group over the Low Gain group, and the percentage difference with the range of the variable as the base. Excluding GNCMPTS (which defines the two groups) the percentage increase of the High group score compared to the Low group score ranged from 9.3% for seeing the importance of history to understanding the present and past to 22.% for LEARN (though much of the increase is due to inclusion of GNCMPTS as part of LEARN). Most of the percentage differences were greater than 12%. The increase in ALLGAIN was 15.8%. Using the range of values as the base, the percentage increase went from 6.3% to 18.3%, with most of the increases greater than 10% (again excluding GNCMPTS). The increase in ALLGAIN was 12.4% and LEARN, 18.3%. The range is 69 for ALLGAIN, 21 for LEARN, and 3 for the CSEQ scores. All differences between the groups are significant at $p<.000$.

[Insert Table 2 about here]

The covariate, COGNITIVE, had a significant but small effect on all the gain variables ($p<.000$). SES also had a small but significant effect on all gain variables ($p<.000$) except for GNCMPTS (gain in familiarity with computers), GNTEAM (gain in ability to be a team member), GNSCI (gain in understanding science), and GNWORLD (gain in knowledge about the world); for these items the significance p was greater than .05.

The means for each group in Table 2 are adjusted for the covariates (i.e., the effects of SES and COGNITIVE have been removed). High Gainers scored significantly higher on ALLGAIN (62.47) compared with Low Gainers (53.93), on LEARN (21.29 to 17.44) and all of the other individual gain measures (Table 2). In some areas, the difference in means between High and Low Gainers was relatively small. For example, a difference of only about .2 of a scale point (about 6% of the

scale range) separated the two groups on gains in the arts and literature. But for some other gains (quantitative thinking, analytic thinking, awareness of other philosophies, writing) the spread was at least .4 or 12% to 14% of the scale range indicating differences that may have practical as well as statistical significance.

Table 3 summarizes the results from the second and third steps in the analysis, the examination of the results from the regression and partial correlations of the LEARN variables to overall gains (ALLGAIN). All the variables are significant ($p<.000$). The listed R^2 is the model R^2 as each variable was entered into the model. The beta weights are for the final model when all variables were entered. The zero order correlations are for each of the independent variables with ALLGAIN. The partial correlations represent the relationships between each variable with ALLGAIN after the effects of the other independent variables are removed. The results from the linear regression showed that the components of the LEARN gain (including GNCMPTS) account for 79.1% of the variation in overall gains as measured by ALLGAIN. Thus the seven components of LEARN explain a large portion of the overall gains in college.

[Insert Table 3 about here]

The beta weights indicate that GNCMPTS (.155) had little influence on ALLGAIN bit GNANALY (.251) had substantial influence. The combination of the R^2s and beta weights suggest that GNCMPTS interacts a good bit with the other gains measures and plays an important role in explaining the variation of ALLGAIN. At the same time, a high score on GNCMPTS itself did ill not increase ALLGAIN substantially. The magnitudes of the partial correlations (Table 3) are consistent with the regression results in that GNCMPTS by itself (.449) does not have a great impact on ALLGAIN. But when the interactions of GNCMPTS with other gains are removed its impact is at least modest (.300), similar to that of other gains on ALLGAIN. Thus, GNCMPTS influences overall gains (ALLGAIN) mainly through its interactions with other gains.

The final step in the analysis (Table 4) repeats the previous regression and correlation analysis with LEARN as the dependent variable. Although GNCMPTS is a weak contributor (beta of .155) to the variation in ALLGAIN, it has a strong influence on the variation in LEARN (a beta of .242). That is, while GNCMPTS affects overall gains (ALLGAIN), it has a greater impact on LEARN, which represents skills and competencies that are an essential foundation for continuous learning after college. Indeed, GNCMPTS had the greatest influence on LEARN with a beta of .242 even though it was only moderately correlated (.561) with LEARN. This suggests that increases in gains in understanding computers may be important to continuous learning after college but that familiarity with computers does not by itself explain the variation students report in the degree to which they acquire these skills and competencies (LEARN).

[Insert Table 4 about here]

Discussion

The results of this study unequivocally demonstrate that familiarity with computers contributes to, and does not detract from, the development of other skills and competencies considered to be important to success after college. Students who become the most familiar with computers (High Gain group) outscored their Low Gain counterparts on every outcome measure used in this study: the 23 individual CSEQ gain scores, ALLGAIN (which is the sum all 23 gains), and LEARN, which is the sum of seven gains thought to be the foundation for continuous learning after college. In some areas we would expect students who are competent with computers to outperform other students, such as in quantitative and analytical skills or in understanding new scientific and technological developments. But High Gainers also scored significantly higher on learning how to function as a team member (2.90 to 2.52, a 12.3% difference in gain based on the range) and becoming aware of different philosophies, cultures, and ways of life (2.75 to 2.37, a 12.7% difference).

Apparently computer use does not hinder the cultivation of such social skills as working effectively with others. By removing the obstacles of time and place, computers may make it easier for students to work together more frequently which produces the indirect positive effect of increased interpersonal competence (Alavi, 1994; Oblinger & Maruyama, 1996). In addition, gains in synthesis skills (ability to put ideas together), writing, and self-understanding are also enhanced, which is the goal of electronic portfolio projects where students provide evidence of their learning and personal development associated with their college experience (LaPlante & Springfield, 1997; Pack, 1998). Thus, the skills and competencies that are represented by the LEARN score are not only linked in the abstract to what both students and employers consider to be important to after-college performance (Deden & Carter, 1996) but also strongly contribute to learning during college.

At the same time, though, computing and other information technologies may have unintended questionable or negative side effects. Reallocating institutional resources to IT means that other potentially productive and useful activities cannot be supported. Additional research is needed to determine the impact of omnipresent IT, which prompted the characterization of the dorm room as a "24 hour communications terminal" mentioned earlier; perhaps constant exposure to such technology exacts a toll on certain students in ways that are not yet apparent. Also, it is possible that students who use computers frequently and benefit more differ in ways that could not be discerned from the data in this study. It would be instructive to know, for example, whether High Gain students were pre-disposed to use IT because they attended high-tech high schools. Finally, not all students have equal access to computing and information technology (Higher Education Research Institute, 1998; Pinheiro, 1997) which can unintentionally widen the gap in opportunities for learning between those with different amounts of educational capital.

Implications

The findings suggest three immediate implications for policy and practice. First, all students should be encouraged to become proficient with computers and other forms of information technology as soon as possible, ideally before they matriculate, in order to take full advantage of the rich array of learning opportunities inherent in most postsecondary educational environments. Second, because IT appears to enhance learning and personal development in a variety of areas, it is imperative that public and institutional policies ensure that such resources are available to all students at every college and university. Finally, every institution is obligated to determine how students are using information technology and how institutional IT policies and practices affect student learning, not only in areas linked with a traditionally view of computer science (e.g., analytical thinking, scientific developments), but in a variety of other important learning and personal development outcomes. These outcomes include the ability to learn on one's own and discover information, to get along with different kinds of people, to discern relationships and put disparate ideas together, to function effectively as a team member, and to write clearly and effectively.

Limitations

One limitation of the study is that it is based on a convenience sample of institutions drawn from the national CSEQ data base. If data from other institutions were available perhaps the results would differ in some ways. Another limitation is that practices at certain institutions in the study may have skewed the findings. For example, some colleges (e.g., Wake Forest University) require matriculating students to purchase a lap-top computer which is used in innovative ways in the curriculum. Other institutions might have state-of-the-art networks, hardware, and software that provide unusually rich opportunities for their students to become familiar with and use information technology. In addition, the CSEQ gain item related to computers does not differentiate among different types of IT or access (e-mail, Internet, web-based activities) which could affect student responses to this item. Finally, the third edition of the CSEQ does not provide information about the amount of time and effort students expend using information technology and for what purposes. Such a scale has been added to the new fourth edition (Pace & Kuh, 1998).

Conclusions

Becoming familiar with computers during college appears to enhance the acquisition of skills and competencies in areas widely believed to be essential for being self-sufficient, economically productive, and socially responsible after college (e.g., self-directed learning, writing clearly, and solving problems both independently and when working with others). Moreover, students who make substantial progress in using computers are no different in terms of their background characteristics or academic ability (as indicated by comparable grades and educational aspirations) than their peers who report little progress except for two things: they study more and they gain more

from college. These findings suggest that concerns about the potentially negative impact of computers on student development are unfounded. In fact, as proponents of information technology assert, the opposite appears to be true as learning about computers goes hand-in-hand with acquiring other desirable skills and competencies associated with college attendance. For this reason, every student should have opportunities to enhance their learning through becoming familiar with and using computers and information technology in educationally purposeful ways.

References

Abeles, T.P. (1998). Perplexed about technology. On The Horizon, 6(4), 14-16.

Alavi, M. (1994, June). Computer-mediated collaborative learning: An empirical evaluation. MIS Quarterly, 159-174.

Black, J. (1997, January). Online students fare better. World Wide Web Virtual Library: Distance Education. Available: http://www.powerwatch.org,uk/appl.html#computer

Bothan, G. (1998). Distance education: Effective learning or content-free credits. Cause/Effect [Online journal], 21(2), Available: http://www.educause.edu/ir/library/html/cem9827.html

Brandt, R. M. (1958). The accuracy of self estimates. Genetic Psychology Monographs, 58, 55-99.

Carnegie Foundation for the Advancement of Teaching (1994). A classification of institutions of higher education. Princeton, NJ: Carnegie Foundation for the Advancement of Teaching.

Deden, A., & Carter, V.K. (1996). Using technology to enhance students skills. In E. Jones (Ed.), Preparing competent college graduates: Setting new and higher expectations for student learning. New Directions for Higher Education, No. 96 (pp. 81-92). San Francisco: Jossey-Bass.

DeNisi, A.S., & Shaw, J.B. (1977). Investigation of the uses of self-reports of abilities. Journal of Applied Psychology, 62, 641-644.

Dolence, M.G., & Norris, D.M. (1995). Transforming higher education: A vision for learning in the 21st century. Ann Arbor, MI: Society for College and University Planning.

Ehrmann, S.C. (1995). Asking the right questions: What does research tell us about technology and higher learning? Change, 27(2), 20-27.

Ewell, P.T., & Jones, D.P. (1996). Indicators of "good practice" in undergraduate education: A handbook for development and implementation. Boulder, CO: National Center for Higher Education Management Systems.

Green, D.C., & Gilbert, S.W. (1995). Great expectations: Content, communications, productivity, and the role of information technology in higher education. Change, 27(2), 8-18.

Green, K.C. (1996). The coming ubiquity of information technology. Change, 28(2), 24-28.

Gilbert, S.W. (1996). Making the most of a slow revolution. Change, 28(2), 10-23.

Hannum, W. (1996). Transforming education with technology. On The Horizon, 4(6), 8-9.

Hansford, B.C., & Hattie, J.A. (1982). The relationship between self and achievement/performance measures. Review of Educational Research, 52, 123-142.

Hibbs, J.W. (1999). Will universities be relics? What happens when an irresistible force meets an immovable object? On The Horizon, 7(1), 10-11.

Higher Education Research Institute (1999). Freshmen embrace the internet as an educational tool. Los Angeles: UCLA Graduate School of Education & Information Studies.

Johnstone. D.B. (1993). Enhancing the productivity of learning. AAHE Bulletin, 46(4), 3-8.

Kozma, R.B., & Johnston, J. (1991). The technological revolution comes to the classroom. Change, 23(1), 10-23.

Kuh, G.D., Connolly, M.R., & Vesper, N. (1998, April). A comparison of educational gains of college seniors between the mid 1980s and the mid-1990s. Paper presented at the annual meeting of the American Educational Research Association, San Diego.

Kuh, G.D., Vesper, N., Connolly, M.R., & Pace, C.R. (1997). College Student Experiences Questionnaire: Revised norms for the third edition. Bloomington, IN: Indiana University Center for Postsecondary Research and Planning.

LaPlante, M.J., & Springfield, E.C. (1997). The Kalamazoo electronic student portfolio. About Campus, 2(5), 26-27.

Lowman, R.L., & Williams, R.E. (1987). Validity of self-ratings of abilities and competencies. Journal of Vocational Behavior, 31, 1-13.

Mallam, S.H., & Wee, L.C. (1998). The round table room: Using technology in setting team standards. About Campus, 3(1), 24-25.

Morrison, J.L. (1999). The role of technology in education today and tomorrow: An interview with Kenneth Green, Part II. On The Horizon, 7(1), 2-5.

Oblinger, D., & Maruyama, M. (1996). Distributed learning. Boulder, CO: CAUSE Professional Paper Series, No. 14.

Pace, C.R. (1985). The credibility of student self-reports. Los Angeles: University of California, The Center for the Study of Evaluation, Graduate School of Education.

Pace, C.R. (1990). College Student Experiences Questionnaire, Third Edition. Los Angeles: University of California, The Center for the Study of Evaluation, Graduate School of Education. (The CSEQ is now distributed by the Center for Postsecondary Research and Planning, Indiana University).

Pace, C.R., & Kuh, G.D. (1998). College Student Experiences Questionnaire, Fourth Edition. Bloomington, IN: Indiana University Center for Postsecondary Research and Planning.

Pack, D.H. (1998). WINGS: The Winona State University electronic portfolio project. About Campus, 3(2), 24-26.

Pascarella, E.T., & Terenzini, P.T. (1991). How college affects students: Findings and insights from twenty years of research. San Francisco; Jossey-Bass.

Pike, G.R. (1995). The relationships between self reports of college experiences and achievement test scores. Research in Higher Education, 36, 1-22.

Pinheiro, E.H. (1997). Universal access through mobile computing. About Campus, 2(2), 25-27.

Rhodes, J.C., (1999). Video survey results. Unpublished manuscript. Bloomington, IN: Indiana University Office of Enrollment Services.

Twigg, C.A. (1995). The need for a national learning infrastructure. Washington, DC: Educom.

Twigg, C.A. (1997). The promise of instructional technology. About Campus, 2(1), 2-3.

Upcraft, M.L., Terenzini, P.T., & Kruger, K. (1999). Looking beyond the horizon: Trends shaping student affairs--Technology. In C. Johnson and H. Cheatham (Eds.), Higher education trends for the next century: A research agenda for student success (pp. 30-35). Washington, DC: American College Personnel Association.

West, T.W. (1996). Make way for the information age: Reconstruct the pillars of higher education. On The Horizon, 4(4), 1, 4-5.

Table 1
Comparison of Means of Background Variables

Variable	High Group Mean	Low Group Mean	Sig.
Age of student	1.24	1.28	0.000
Gender of student	1.60	1.62	0.000
Most college grades	3.27	3.20	0.000
Hours/week spent on school work	3.16	2.97	0.000
Hours/week spent working on job	2.46	2.45	0.501
Expect to enroll for advanced degree	1.26	1.26	0.194
Either parent graduate from college	1.92	1.92	0.567
Part of expenses provided by family	2.37	2.35	0.001

Table 2
Differences in Gain Variables for Low and High Gainers
(Means Corrected for SES and Cognitive Ability)

Variable	Corrected High Mean	Corrected Low Mean	High – Low	% Difference High to Low	% Difference Range
Allgain	62.51	53.98	8.53	15.80%	12.36%
Learn	21.30	17.45	3.84	22.00%	18.29%
Gain in vocational training	2.55	2.23	0.31	14.10%	10.33%
Gain in specialization for further	2.79	2.53	0.27	10.50%	9.00%
Gain in broad general education	2.90	2.65	0.25	9.40%	8.33%
Gain in career information	2.97	2.65	0.32	12.10%	10.67%
Gain in understanding of arts	2.18	1.99	0.19	9.40%	6.33%
Gain in acquaintance of literature	2.25	2.05	0.20	9.80%	6.67%
Gain in writing clearly and effectively	2.89	2.49	0.40	16.20%	13.33%
Gain in familiarity with computers	3.39	1.68	1.71	102.20%	57.00%
Gain in awareness of other philosophies	2.75	2.37	0.38	16.30%	12.67%
Gain in developing own values & ethics	2.94	2.61	0.34	12.80%	11.33%
Gain in understanding yourself	3.13	2.82	0.32	11.20%	10.67%
Gain in understanding other people	3.09	2.79	0.30	10.60%	10.00%
Gain in ability to be a team member	2.90	2.52	0.37	14.80%	12.33%
Gain in developing health and fitness	2.49	2.21	0.28	12.80%	9.33%
Gain in understanding science	2.28	1.99	0.29	14.50%	9.67%
Gain in understanding science-technology	2.19	1.86	0.33	18.00%	11.00%
Gain in awareness of new technology	2.25	1.93	0.32	16.40%	10.67%
Gain in ability to think analytically	2.93	2.55	0.38	15.10%	12.67%
Gain in quantitative thinking	2.58	2.15	0.43	19.80%	14.33%
Gain in ability to put ideas together	2.98	2.64	0.34	13.00%	11.33%
Gain in ability to learn on own	3.12	2.79	0.33	12.00%	11.00%
Gain in seeing importance of history	2.62	2.40	0.22	9.30%	7.33%
Gain in knowledge about the world	2.33	2.09	0.24	11.50%	8.00%

Table 3
Regression Coefficients with ALLGAIN as the Dependent Variable
Correlations (Zero and Partial) of Independent Variables with ALLGAIN

Independent Variables In The Order Entered In The Model	Adjusted R^2 as Variable Entered	Final Beta	Zero Order Correlation	Partial Correlation
Gain in ability to put ideas together	.500	.196	.707	.279
Gain in understanding other people	.618	.194	.608	.316
Gain in ability to think analytically	.692	.251	.685	.383
Gain in familiarity with computers	.730	.155	.449	.300
Gain in writing clearly and effectively	.758	.158	.536	.290
Gain in ability to be a team member	.776	.163	.578	.275
Gain in ability to learn on own	.791	.170	.670	.262

Table 4
Regression Coefficients with LEARN as the Dependent Variable
Correlations (Zero and Partial) of Independent Variables with LEARN

Independent Variables In The Order Entered In The Model	Adjusted R^2 as Variable Entered	Final Beta	Zero Order Correlation	Partial Correlation
Gain in ability to put ideas together	.590	.199	.768	1.000
Gain in ability to be a team member	.753	.218	.668	1.000
Gain in familiarity with computers	.849	.242	.561	1.000
Gain in writing clearly and effectively	.912	.211	.626	1.000
Gain in ability to learn on own	.950	.201	.745	1.000
Gain in understanding other people	.976	.200	.678	1.000
Gain in ability to think analytically	1.000	.205	.721	1.000

Appendix A: CSEQ Background Variables

Variable/Value	Description
AGE	Age of student
1	22 or younger
2	23-27
3	28 or older
SEX	Gender of student
1	Male
2	Female
GRADES	Most college grades
1	C, C-, or lower
2	B-, C+
3	B
4	A-, B+
5	A
PARGRAD	Either parent graduate from college
1	No
2	Yes, both parents
3	Yes, father only
4	Yes, mother only
ADVDEG	Expect to enroll for advanced degree
1	Yes
2	No
TIMESCH	Hours/week spent on school work
1	Less than 20 hrs/wk
2	About 20 hrs/wk
3	About 30 hrs/wk
4	About 40 hrs/wk
5	About 50 hrs/wk
TIMEWORK	Hours/week spent working on job
1	None, not employed
2	About 10 hrs/wk
3	About 15 hrs/wk
4	About 20 hrs/wk
5	About 30 hrs/wk
6	More than 30 hrs/wk
EXPENSE	Part of expenses provided by family
1	All or nearly all
2	More than half
3	Less than half
4	None or very little

Appendix B: CSEQ Gains Scales

Variable	Gains Scales
GNANALY	Gain in ability to think analytically (*)
GNARTS	Gain in understanding of arts
GNCAREER	Gain in career information
GNCMPTS	Gain in familiarity with computers (*)
GNCONSQ	Gain in awareness of new technology
GNGENLED	Gain in broad general education
GNHEALTH	Gain in developing health and fitness
GNHIST	Gain in seeing importance of history
GNINQ	Gain in ability to learn on own (*)
GNLIT	Gain in acquaintance of literature
GNOTHERS	Gain in understanding other people (*)
GNPHILS	Gain in awareness of other philosophies
GNQUANT	Gain in quantitative thinking
GNSCI	Gain in understanding science
GNSELF	Gain in understanding yourself
GNSPEC	Gain in specialization for further education
GNSYNTH	Gain in ability to put ideas together (*)
GNTEAM	Gain in ability to be a team member (*)
GNTECH	Gain in understanding science-technology
GNVALUES	Gain in developing own values & ethics
GNVOC	Gain in vocational training
GNWORLD	Gain in knowledge about the world
GNWRITE	Gain in writing clearly and effectively (*)

Note: The components of the gain LEARN are marked with an asterisk.

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

ERIC®

REPRODUCTION RELEASE

(Specific Document)

AERA 1999

I. DOCUMENT IDENTIFICATION:

Title: DO COMPUTERS ENHANCE OR DETRACT FROM STUDENT LEARNING

Author(s): KUH, GEORGE D. & VESPER, NICK

Corporate Source: INDIANA UNIVERSITY STATE STUDENT ASSISTANCE COMMISSION OF IN

Publication Date: PRESENTATION APRIL 20, 1999

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic media, and sold through the ERIC Document Reproduction Service (EDRS). Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following three options and sign at the bottom of the page.

The sample sticker shown below will be affixed to all Level 1 documents	The sample sticker shown below will be affixed to all Level 2A documents	The sample sticker shown below will be affixed to all Level 2B documents
PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY Sample TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 1	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE, AND IN ELECTRONIC MEDIA FOR ERIC COLLECTION SUBSCRIBERS ONLY, HAS BEEN GRANTED BY Sample TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 2A	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY Sample TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 2B
Level 1 ↑ [X]	Level 2A ↑ [ ]	Level 2B ↑ [ ]
Check here for Level 1 release, permitting reproduction and dissemination in microfiche or other ERIC archival media (e.g., electronic) *and* paper copy.	Check here for Level 2A release, permitting reproduction and dissemination in microfiche and in electronic media for ERIC archival collection subscribers only	Check here for Level 2B release, permitting reproduction and dissemination in microfiche only

Documents will be processed as indicated provided reproduction quality permits.
If permission to reproduce is granted, but no box is checked, documents will be processed at Level 1.

I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche or electronic media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries.

Sign here,→ please

Signature: Nicholas J. Vesper	Printed Name/Position/Title: NICHOLAS J. VESPER
Organization/Address: SSACI 150 W. MARKET, INDPLS, IN 46204	Telephone: 317 233 5094 / FAX: 317 232 3260
	E-Mail Address: NVESPER@SSACI.STATE.IN.US / Date: 4/20/99

(over)

III. DOCUMENT AVAILABILITY INFORMATION (FROM NON-ERIC SOURCE):

If permission to reproduce is not granted to ERIC, *or*, if you wish ERIC to cite the availability of the document from another source, please provide the following information regarding the availability of the document. (ERIC will not announce a document unless it is publicly available, and a dependable source can be specified. Contributors should also be aware that ERIC selection criteria are significantly more stringent for documents that cannot be made available through EDRS.)

Publisher/Distributor:
Address:
Price:

IV. REFERRAL OF ERIC TO COPYRIGHT/REPRODUCTION RIGHTS HOLDER:

If the right to grant this reproduction release is held by someone other than the addressee, please provide the appropriate name and address:

Name:
Address:

V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

However, if solicited by the ERIC Facility, or if making an unsolicited contribution to ERIC, return this form (and the document being contributed) to:

ERIC Processing and Reference Facility
1100 West Street, 2nd Floor
Laurel, Maryland 20707-3598

Telephone: 301-497-4080
Toll Free: 800-799-3742
FAX: 301-953-0263
e-mail: ericfac@inet.ed.gov
WWW: http://ericfac.piccard.csc.com